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AUTHOR Reder, Lynne M.; And Others
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ABSTRACT

Elderly subjects and college-age subjects were compared on the strategy used to answer a question based on information in memory. The two strategies studied were direct retrieval and plausibility. The first experiment tested the hypothesis that older subjects will rely on the plausibility strategy more than young subjects. A second experiment tested the hypothesis that the different pattern of data is due to processing differences, not differences in the strength of episodic memory traces. Performance was slower in general for older subjects. However, older subjects also tended to modify their performance to minimize the detrimental effects of inferior retention of specifics. In some conditions, older subjects outperformed young subjects even in terms of response time. This resulted from their propensity to use a strategy that depends less on exact memory and that can be more efficient in some circumstances. This strategy involved using consistency as opposed to a careful inspection of the nature of relationships found in memory. (YLB)

MEMORY CHANGES WITH AGE - COMPENSATING SHIFTS IN STRATEGY

LYNNE M. REDER

Carnegie-Mellon University

JOHN C. MARTIN

Carnegie-Mellon University

CYNTHIA WIBLE

Carnegie-Mellon University

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MEMORY CHANGES WITH AGE - COMPENSATING SHIFTS IN STRATEGY

When a person is asked to answer a question based on information in memory, there are two strategies commonly used:

- One is to try to find a close match in memory to the question, which we call the *direct retrieval strategy*.
- The other is to try to infer the answer from information found in memory that seems related, which we call the *plausibility strategy*.

One way to influence which strategy is used is to either ask a person

(a) to recognize whether the statement was seen before and discriminate it from other statements consistent with what is known but not seen before,

or

(b) to judge whether a statement is plausible given what is already known, although the exact statement may not have been seen.

People are more inclined to try direct retrieval when asked to recognize than they would be if asked to judge plausibility and vice-versa. However, the task *required* of people does not totally predict, by any means, which strategy people will adopt to answer a question.

This research tests several hypotheses. They are:

1. The plausibility strategy tends to be adopted more as memories decline, and therefore will be adopted sooner by the elderly.
2. The plausibility strategy involves more automatic processes while recognition can involve more controlled, conscious processing.
3. Performance on tasks involving automatic processes will be *comparable* for young and old subjects, while aged subjects' performance will be *deficient* in situations requiring more controlled processes.

The first hypothesis involves using elderly subjects as a converging measure for general principles I want to assert about human memory. The first half of this hypothesis, that the plausibility strategy tends to be adopted more as memories decline, has already been shown with college students. The second half is the experimental test with older subjects. It should provide converging evidence for the theoretical interpretation of these earlier results.

The other two hypotheses test a principle to differentiate older people from younger people. If these tests are supported, they would provide converging evidence for the theory of Hasher & Zacks who have found that automatic processes do not decline with age, while controlled

processes do

EXPERIMENT 1

The first experiment tests the hypothesis that older subjects will rely on the plausibility strategy more than young subjects regardless of "official task characteristics."

METHOD

Subjects read a series of stories about which a number of inferences could be made.

- Some of these inferences were later asked as questions about the story.
- Of those to be asked as questions, half were randomly selected to be asserted in the story as part of the story.
- Subjects were randomly assigned to task. The two separate tasks were whether the subject was asked to make recognition judgments ("Did you see this sentence in the story?"), or asked to make plausibility judgments ("Is this statement plausible given the story you read?").
- Across subjects all statements appeared in the recognition stated and not-stated conditions and the plausibility stated and not-stated conditions. There were an equal number of implausible statements for the plausibility condition.
- Some subjects answered questions after each story, and some answered after reading all ten stories.

To summarize, the design employs a 2x2x2x2 factorial where age of subjects is the only between-subject factor. The other factors are whether the statement was stated in the story, whether the questions are asked after each story or after all ten stories, whether subjects are asked to make recognition or plausibility judgments and whether plausible statements are highly or moderately plausible. Random assignments were done separately for each subject (except, of course, the plausibility of the statements and age of subjects were not randomly assigned).

Below is an example of part of a story subjects might see:

The heir to a large hamburger chain was in trouble.

He had married a lovely young woman who had seemed to love him.

Now he worried that she had been after his money all along.

Perhaps he consumed too much beer and french fries.

No, he couldn't give up fries.

Not only were they delicious, he got them for free!

The heir got his fries from his father's hamburger chain.

The heir decided to join weight watchers.

Twenty-five pounds later, the *heir realized his wife did love him after all.*

Recognition (Y) or Plausibility Stated)	The heir got his fries from his father's hamburger chain.
Recognition (No) or Plausibility (Not Stated)	The heir wanted to lose weight.
Implausible	The heir was a teetotaler.

* * * * * * * * *

The item in italics is tested as a question later. (It was not italicized for subjects.) Subjects would say yes to this question regardless of task. The second question, not-stated, should be rejected for people asked to do recognition, but accepted by those asked to do plausibility. The final question was asked only in the plausibility task so that half of the items would be rejected.

The young subjects that had been used in this study were C-MU college students. The older subjects were C-MU alumni volunteers, age 65-80, with a mean age of 72 and in good health.

RESULTS

The results of the first experiment are shown in the attached appendix (Graph 1). The left panel plots reaction time to correct responses for plausible statements as a function of delay for the two age groups in the two tasks. Each function collapses over presented vs. not-presented in the story and plausibility of statement.

- Not surprisingly, young subjects are faster overall.
- However, there is a significant interaction of task with age; old subjects are much slower to do recognition than plausibility, while, if anything, the young are faster to do recognition.
- Accuracy, plotted on Graph 2, shows another interaction of task with age. Plausibility is more accurate for both groups, but the difference in accuracy due to task is much larger for old subjects. Older subjects are the most accurate for plausibility, and are the worst for recognition.

The interpretation of this pattern of data for older subjects was expected from the interpretation of the college data collected earlier (Reder, 1982).

- Subjects tend to use the plausibility strategy a lot in the recognition task when traces

are weak.

- It seems that traces are weak even in the immediate condition for older subjects, so they often use the plausibility strategy, even in immediate recall situations.

- Young subjects start by using direct retrieval most often, even in the plausibility task, but shift strategy preference with delay. The speed up in reaction time with delay for the plausibility function is due to the not-stated items. When direct retrieval is tried first, the strategy fails, and people then try plausibility in the plausibility task. This accounts for the much slower initial reaction, because subjects start out using the wrong strategy.

- Using the plausibility strategy does not hurt accuracy in plausibility task or for presented statements in the recognition task. However, accuracy for statements not-presented that should be responded to negatively are really hurt by using the plausibility strategy in the recognition task.

The next graph (Graph 3) breaks down accuracy just for the recognition task. Plotted is accuracy in the recognition task as a function of whether the item should be responded to positively (stated) or rejected (not-stated) for the two age groups.

- Again, old are better than young where the plausibility strategy will work, viz., for stated items.

- Again, old subjects are worst, and well below chance, where the plausibility strategy won't work effectively, i.e., not-presented statements that should be rejected.

- Note that, with delay, recognition performance declines for both old and young for not-stated items, but stays high where plausibility can be used.

The RT data are also consistent with this analysis. Reaction times for stated items in the recognition task are done at the same speed as plausibility. The not-stated correctly answered are much slower.

There are two possible reasons for why older subjects use the plausibility strategy more:

1. Older subjects' memories are much weaker, so they adopt this strategy sooner.

2. Plausibility strategy involves making AUTOMATIC relatedness judgments and does not require the CAREFUL INSPECTION OF INTERSECTIONS found in memory that is necessary for the direct retrieval strategy.

EXPERIMENT 2

To test the hypothesis that the different pattern of data is due to processing differences, not differences in the strength of episodic memory traces, the second experiment used a semantic memory task. The task was a simple one where subjects saw two words displayed on a screen and made a category-membership judgment. The top word was a category name and the bottom word would be an instance of it 50% of the time. Half of the instance words were dominant,

i.e., first or second highest frequency listed in the Battig-Montague norms for that category name. The other half were low dominance, viz., the lowest frequency listed.

Half of the non-instances were highly related. For non-instances, we asked other college subjects to free associate to category names and selected the most frequent non-instances from those given. The 48 category names used in this experiment were randomly assigned to one of the four conditions.

The examples listed below represent all four types of materials used in the four conditions.

INSTANCE

DOMINANCE:	HIGH	LOW
	Country	Country
	Russia	Iceland

NONINSTANCE

RELATEDNESS	HIGH	LOW
	Country	Country
	Continent	Lemonade

The subjects for this experiment were all alumni. The young subjects were between 25 years of age and 31, and the old subjects were between 64 and 75 years old.

RESULTS

The results of this experiment are shown in Graph 4.

The top panels plot accuracy and the bottom panels plot response time (in milliseconds) for correct responses. Each are plotted separately for instance and non-instance as a function of dominance or relatedness. First, consider the accuracy data.

For instances, old subjects are at least as accurate as young. For high dominant items, which means they are highly similar or associatively related, older subjects are most accurate and are more accurate than young subjects.

For non-instances, both groups of subjects have trouble with highly related items and neither have trouble with unrelated non-instances. For highly related non-instances, however,

older subjects are appreciably worse than younger subjects.

To summarize:

- When relatedness can facilitate judgment, older subjects are better than young; when it gives the wrong response, older subjects are worse.

- When the relatedness value suggests rejection, older subjects do fine, too.

Now consider reaction time data:

- Old subjects are always slower, perhaps due to slower motor responses. The advantage for high dominance is somewhat larger for them than for young (302 msec. instead of 249).

- Where relatedness hurts, old subjects are appreciably slower on the correct responses. The reaction time difference is 50% larger than other young-old comparisons; the difference between high and low relatedness is three times as large for old as for young.

CONCLUSIONS

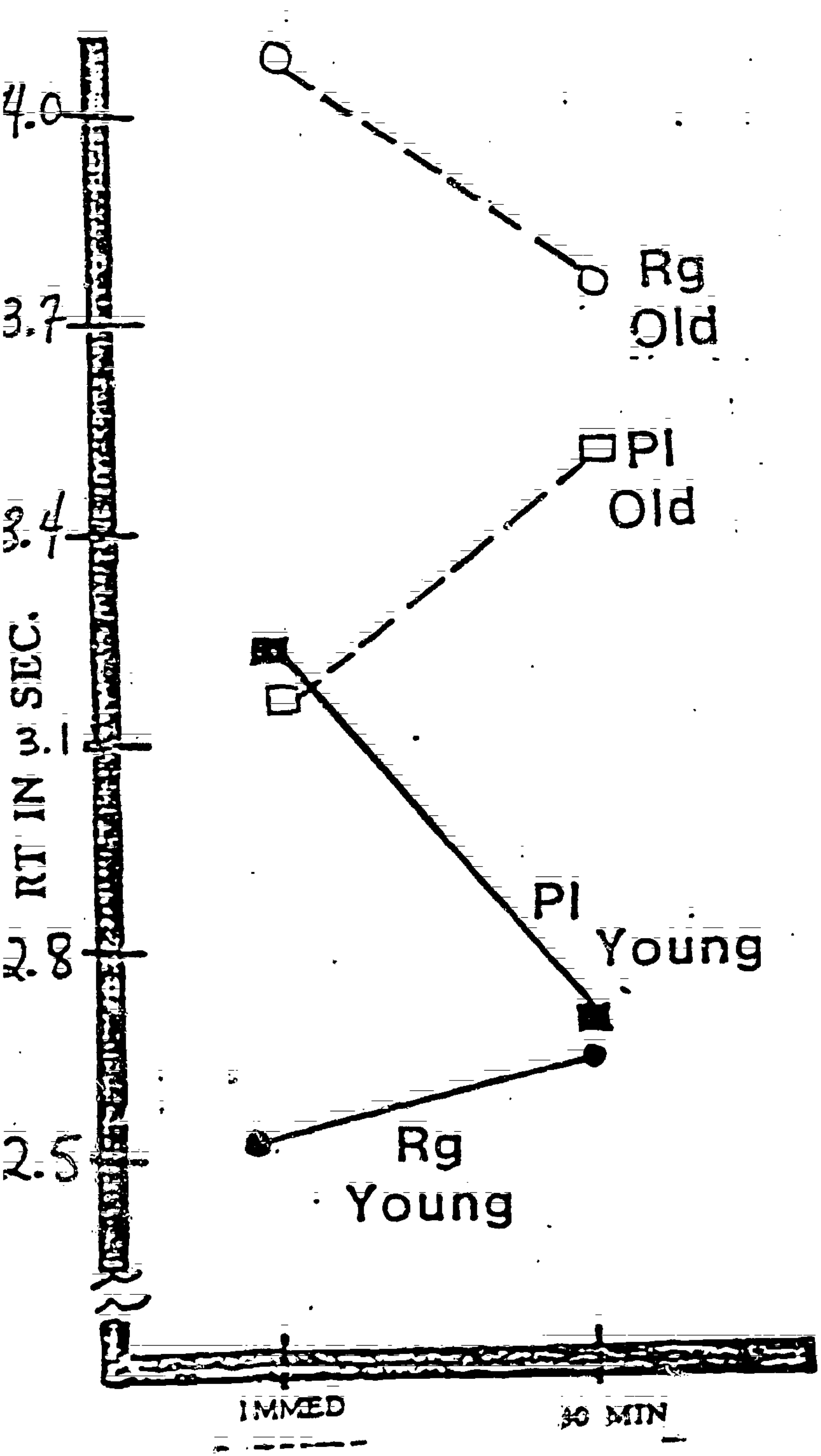
- Older subjects can use the automatic relatedness process quite well. Performance is as good as or better than young subjects.

- Careful inspection of retrieved, related material is more difficult for everybody, but much more so for older subjects.

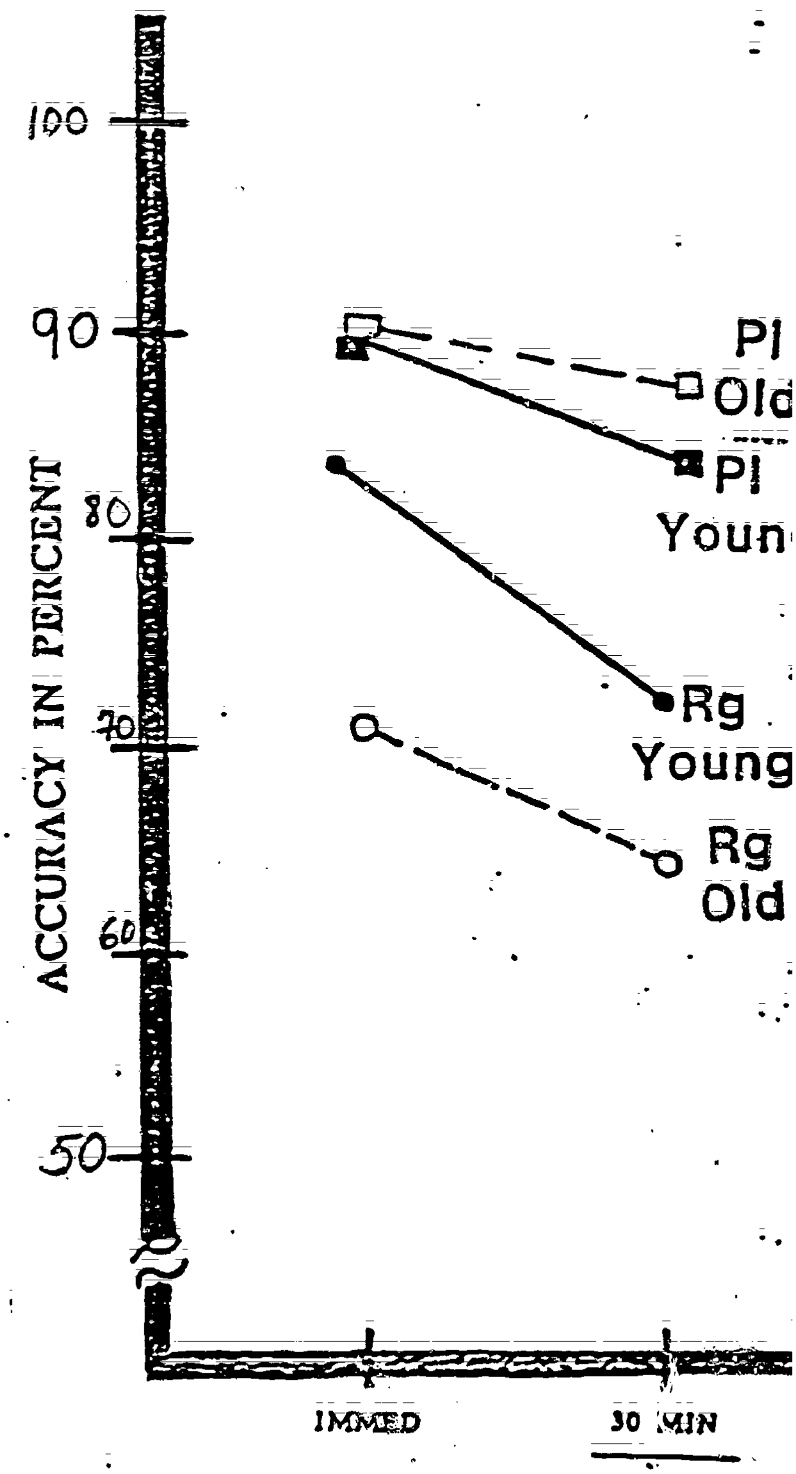
- This interpretation is consistent with the position of Hasher and Zacks, that automatic processes do not decline with age, while controlled ones do.

- It's reasonable that a relatedness or plausibility strategy is more stable across age: its faster, more efficient, and the preferred strategy for everyone (the one we use daily). Therefore, the plausibility strategy has become automatic with practice.

As support for the claim that people normally use plausibility, consider the results from Erikson & Mattson. When they asked people, "How many animals of each kind did Moses take on the Ark?", people often erroneously answered "2". There are few "trick questions" in everyday life, so we do not have to discriminate inferences from exact statements; therefore, the automatic plausibility processes that remain in old age keep the aged in good stead.

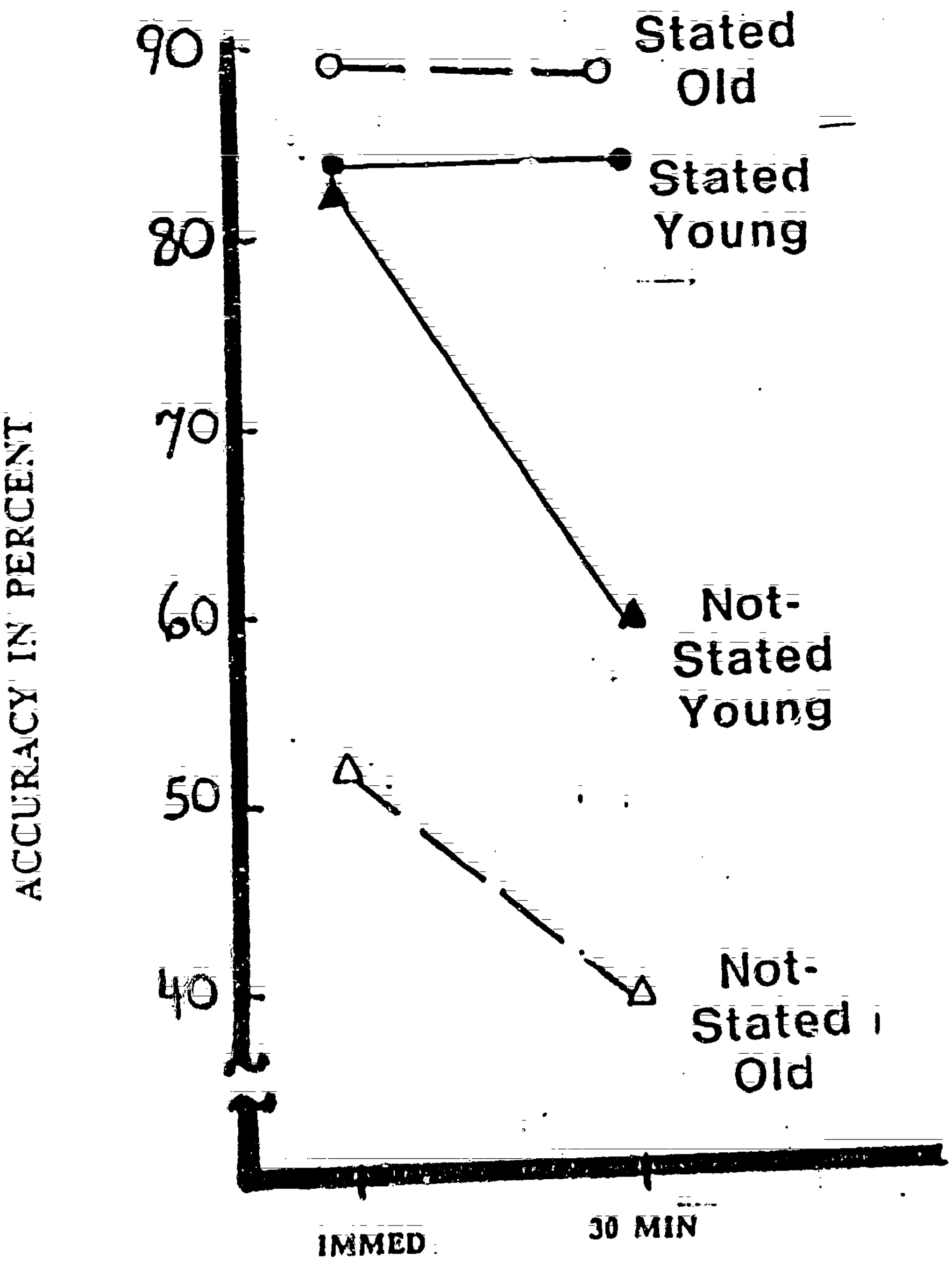


Graph 1

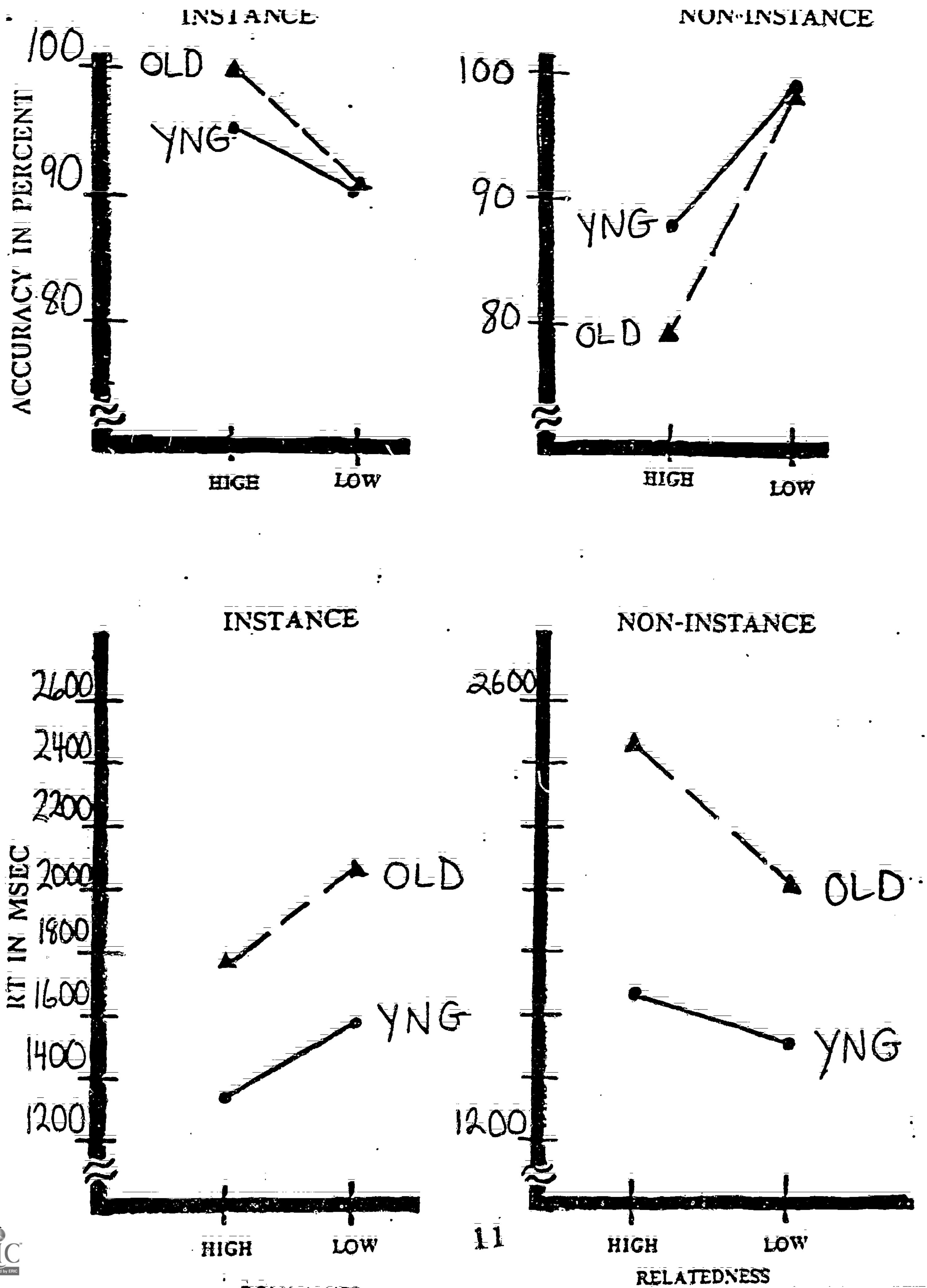


Graph 2

RECOGNITION



Graph 3


INSTANCE
NON-INSTANCE
ACCURACY IN PERCENT
100
90
80
OLD
YNG
HIGH
LOW
INSTANCE
NON-INSTANCE
RT IN MSEC
2600
2400
2200
2000
1800
1600
1400
1200
OLD
YNG
HIGH
LOW
RELATEDNESS